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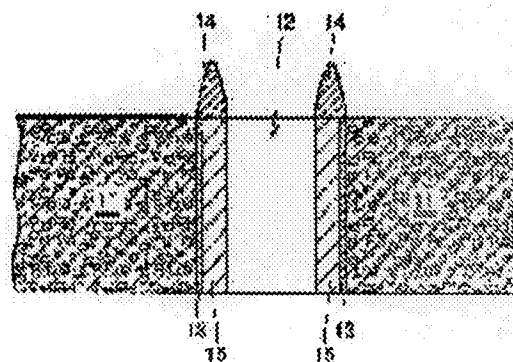
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(54) ANISOTROPIC CONDUCTIVE SHEET, AND MANUFACTURING METHOD OF THE SAME

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an anisotropic conductive sheet enabled to obtain a good electrical contact only by contacting the sheet to an aluminum electrode pad, and to provide a manufacturing method with few man-hours and a high aspect ratio.

SOLUTION: The anisotropic conductive sheet is made of porous material with insulation property, and has cavities penetrating in the direction of the thickness, and has conductivity only in the direction of the thickness because of the metal layer covering the inner wall of cavities, and a conductive protrusion is formed at least to one end of the opening.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]**[0001]**

[Field of the Invention]This invention relates to an anisotropic conducting sheet used for the inspection of a semiconductor wafer etc., and a manufacturing method for the same.

[0002]

[Description of the Prior Art]Various kinds of tests done after completion of wafer manufacture are done in order to evaluate whether it agrees in the performance criteria of the system which agrees in a design basis with an electric chip or with which it is equipped, or operation has reliability.

Also in these, the reliability test of a chip sends a test signal to a chip, and is done by the method of carrying out repetition operation, and a chip with a defect is eliminated.

By the test which promotes the defect of a chip, it is carried out under a 150-200 °C hot atmosphere. It is called a burn in test and, as for this test method, the measurement substrate to be used also needs to have heat resistance.

[0003]Although the test of such a chip is done via the electrode pad which consists of aluminum of a wafer surface, etc., in order to compensate the loose connection by the mismatching of the smoothness of this electrode pad and the head electrode of a measuring device, it is usually done on both sides of an electric conduction sheet between the electrode pad of a sample, and the electrode of a measuring device. Although this electric conduction sheet has conductivity in the thickness direction of a sheet, in order to keep a ***** pad from flowing, it is insulated in the plane direction of the sheet. Therefore, this sheet is called an anisotropic conducting sheet.

[0004]About the anisotropic conducting sheet, it is already indicated by JP,10-144750,A. Although this sheet consists of a porous material of electric insulation, such as polyolefine and polyurethane, an electrical conductive channel is formed and this field has conductivity by covering each ingredient of the porous material in the certain area of a sheet with a metal layer, Since an adjoining field is insulation, it conducts current only to a thickness direction via the field in which the electrical conductive channel was formed.

[0005]It is the same anisotropic conducting sheet as the above, and what contains elastomers, such as silicone, in a porous material is indicated by JP,10-149722,A. Since this sheet contains an elastomer, it is compressible to 25 to 75%, and since it is non cohesiveness and non adhesion nature, silicone is easy to dissociate, and when a reuse can be carried out, there is.

[0006]One of the manufacturing methods of these anisotropic conducting sheets is indicated by JP,10-149722,A. This method dips a porous material in the solution of the synchrotron radiation susceptibility material which contains a photosensitive reducing agent, metal salt, the source of halide ion, and the 2nd reducing agent first, After drying, cover with the mask of specified shape and it puts to synchrotron radiation, such as ultraviolet rays, After changing the metal salt which deposited in the sheet by synchrotron radiation to non-conducting metal nuclei and removing a mask, the synchrotron radiation susceptibility material in the field protected by the mask is washed out, it puts to the cation substitution solution of metal, such as the precious metals, and it is stabilized. It dries, after putting to the solution of a conductive metal salt after making a metallic cation deposit, and performing electroless deposition. The non-conducting metal nuclei produced by the exposure of synchrotron radiation carry out the catalyst of the deposit of a conductive metal from the solution of unelectrolyzed metal salt in this electroless deposition. In the obtained sheet, since the conductive metal deposits, when the field which was not protected by the mask has conductivity in a thickness direction, there is.

[0007]

[Problem(s) to be Solved by the Invention]However, the electrode pad of the wafer surface was usually a product made from aluminum, and since the surface of the aluminum electrode was covered with the comparatively firm oxide film, any above-mentioned anisotropic conducting sheet had the problem that electric contact good by only comparing to an aluminum electrode pad was not obtained.

[0008]An easy and cheap manufacturing method of cost which does not need complicated processing of being impregnated of synchrotron radiation susceptibility material, washing after exposure, etc. as a manufacturing method of an anisotropic conducting sheet was desired.

[0009]This invention tends to provide the anisotropic conducting sheet in which electric contact good only by comparing to an aluminum electrode pad is obtained. There are few routing counters and they aim at providing the manufacturing method of the anisotropic conducting sheet which has a high aspect ratio.

[0010]

[Means for Solving the Problem]An anisotropic conducting sheet of this invention consists of a porous material of electric insulation, has the cave penetrated to a thickness direction, has conductivity only in a thickness direction by covering a wall of a cave with a metal layer, and installed a conductive projection in the edge of at least one opening of a cave side by side.

[0011]As for a porous material, what an aperture becomes from distraction polytetrafluoroethylene (henceforth-"ePTFE"-if needed) 0.01-100 micrometers and whose porosity are 30 to 95% is preferred.

[0012]Thing of a metal layer containing gold, silver, and copper is preferred, and, as for a cave covered with this metal layer, it is preferred to cover with an auxiliary layer which consists of an alloy of nickel, a nickel alloy, the precious metals, or the precious metals further.

[0013]As for a projection, what consists of an alloy of nickel, a nickel alloy, the precious metals, or the precious metals is preferred, and when a projection consists of nickel or a nickel alloy, it is preferred to cover a projection with an alloy or copper of the precious metals and the precious metals further.

[0014]An anisotropic conducting sheet of this invention can be manufactured by forming a cave penetrated to a thickness direction and covering a wall of a cave with a metal layer on a sheet which consists of a porous material of electric insulation first continuously, and installing a conductive projection in the edge of

at least one opening of a cave side by side at the last.

[0015]When forming a cave penetrated to a thickness direction of a sheet, it is preferred to use synchrotron radiation and a laser beam with a wavelength of 250 nm or less.

[0016]When installing a projection in the edge of an opening of a time of covering a metal layer to a wall of a cave, or a cave side by side, it is preferred to carry out by plating.

[0017]

[Embodiment of the Invention](Composition of an anisotropic conducting sheet) The anisotropic conducting sheet of this invention, It consists of the porous material 11 of electric insulation as shown in drawing 1, and it has the cave 12 penetrated to the thickness direction, and has conductivity only in a thickness direction by covering the wall of the cave 12 with the metal layer 13, and the conductive projection 14 was installed in the edge of at least one opening of the cave 12 side by side.

[0018]The anisotropic conducting sheet of this invention consists of electric insulation material. Exact data can be taken without being influenced by a ***** chip, when inspecting an IC chip by using electric insulation material.

[0019]As an electric insulation material, since pliability besides electric insulation is needed, polymer, such as cotton, polyester, polyamide, polyolefine, and polyurethane, is preferred, and can consider it as the gestalt of a film, textile fabrics, or a nonwoven fabric according to material. In a burn in test, since heat resistance is required also of an anisotropic conducting sheet, the polymer which carried out fluoride substitution is preferred. As polymer which carried out fluoride substitution, although there are a copolymer of polytetrafluoroethylene, polytetrafluoroethylene, the copolymer of polyester and polytetrafluoroethylene, and fluoridation ethylene-propylene, etc., Especially in these, the field of heat resistance, processability, and a mechanical strength to distraction polytetrafluoroethylene is preferred.

[0020]The anisotropic conducting sheet of this invention consists of porous materials. When an anisotropic conducting sheet inspects an IC chip, use it, inserting between the electrode of a wafer surface and the head electrode of a measuring device which are samples, but. Since an anisotropic conducting sheet consists of porous materials, pliability and cushioning properties can be demonstrated, and the loose connection who results from the poor smoothness of the electrode surface of a sample and the electrode surface of a measuring device can be eased.

[0021]As for the aperture of a porous material, 0.01-100 micrometers is preferred, and its 0.1-20 micrometers are more preferred. If an aperture is set to less than 0.01 micrometer, the pliability and cushioning properties as a porous material will run short, and the above-mentioned effect will become is hard to be acquired. On the other hand, if an aperture becomes larger than 100 micrometers, it will become unstable as a structure and use will become difficult. An aperture means the average diameter of the hole contained in a porous material.

[0022]30 to 95% of the porosity of a porous material is desirable, and is more desirable. [50 to 90% of] If porosity will be less than 30%, the pliability and cushioning properties as a porous material will become insufficient. On the other hand, intensity etc. will become insufficient if porosity becomes larger than 95%. Porosity means the rate (%) of the capacity of a stoma over the total volume of a porous material.

[0023]The anisotropic conducting sheet of this invention has conductivity only in a thickness direction. This sheet has the cave penetrated to the thickness direction, and the wall of the cave is covered with the metal

layer. Therefore, it has conductivity in a thickness direction via the metal layer of a cavernous wall. On the other hand, since a sheet consists of electric insulation material, it is insulated in the plane direction of the sheet. That is, the sheet of this invention is an anisotropic conducting sheet which has conductivity only in a thickness direction. The function in which contact can be electrically taken only with a predetermined chip is exhibited without being influenced by a ***** chip, since it has conductivity only in a thickness direction.

[0024]According to the shape of the electrode pad in the surface of the wafer which is a sample, when a cave is cut at a flat surface parallel to a sheet, shape can be made into circular, an ellipse form, a square, a rectangle, a triangle, etc., and it can also design the size arbitrarily.

[0025]The length of a cave is equal to the thickness of a sheet, since the cave is penetrated to the thickness direction of a sheet, when manufacturing using the synchrotron radiation and the laser beam with a wavelength of 250 nm or less which mention the anisotropic conducting sheet of this invention later, the length of a cave can be a maximum of 1 mm, but. The point which lowers the pliability of a sheet and the electrical resistance of a hollow part as much as possible to 100-500 micrometers are preferred.

[0026]Although it is necessary to design them according to the position of the electrode pad in the surface of the wafer which is a sample, it is preferred to detach not less than 5 micrometers in order to prevent the short circuit between caves, and when 10 micrometers of intervals of caves are detached, they are more preferred.

[0027]The number of caves can also be arbitrarily designed according to the number of the electrode pads in the surface of the wafer which is a sample.

[0028]The thing of a metal layer containing at least one chosen from the group which consists of gold, silver, and copper is preferred. It is because these metal has small electrical resistance. In these, since the balance of a mechanical strength and volume resistivity is good, copper is more preferred.

[0029]As for the thickness of a metal layer, 1-20 micrometers is preferred, and its 3-10 micrometers are more preferred. It is because the path of a cave cannot be made small if thicker [if thinner than 1 micrometer, sufficient conductivity cannot be secured, but] than 20 micrometers.

[0030]As for the anisotropic conducting sheet of this invention, the conductive projection is installed in the edge of at least one opening of a cave side by side. The electrode pad 22 made from aluminum is shown in the surface of the wafer 21 which is a sample, and the coat of comparatively firm oxidation aluminum is formed in the surface of the electrode pad 22 as shown in drawing 2 (a). For this reason, it was interrupted by the coat of oxidation aluminum only by pressing the conventional anisotropic conducting sheet against a sample, and good electric interengagement was not obtained. Since the anisotropic conducting sheet of this invention has a conductive projection in the edge of the opening of a cave, By pressing the electrode 27 (golden coat) of the measuring head 26, the projection 24 of a sheet is pierced in the oxide film of the electrode pad 22 of a sample (the state on the left of drawing 2 (b) is pointed out.), or an oxide film is shaved (the state on the right of drawing 2 (b) is pointed out.). The enlarged drawing is shown in drawing 2 (c). The good electric interengagement of the electrode pad 22 of a sample and the electrode 27 of a measuring device comes to be obtained.

[0031]A projection is provided in both both [one of the two or] of an opening. As shown in drawing 2 (a), the electrode pad 22 of the wafer 21 which is a sample is a product made from aluminum, and the oxide film is formed in the surface of the electrode pad 22 made from aluminum when the golden coat of the electrode 27

of the measuring head 26 is carried out. Therefore, it is preferred that in such a case use the anisotropic conducting sheet only at one of the two of an opening, and the projection 24 uses a field with the projection 24 for a sample, turning it. On the other hand, it is preferred to use the sheet (not shown) in which the both sides of the opening of a cave have the projection 24, when both the electrode pad 22 and the electrode 27 are the products made from aluminum.

[0032]A projection is provided towards a way outside a sheet as it is shown in drawing 3, and two or more projections 34 are installed in the edge of the opening of each cave side by side.

[0033]Since the shape of a projection is pierced in the electrode pad of a sample or it enables it to delete, it can be made a needle, conical shape, campanulate, etc.

[0034]The thickness of the oxide film in the surface of the electrode pad made from aluminum is 30-100 nm, and as for the length of a projection, 10-100 micrometers is preferred in order to obtain good electric interengagement by penetrating or shaving this oxide film.

[0035]As for the construction material of a projection, any one of the alloys of nickel, a nickel alloy, the precious metals, or the precious metals is preferred, and it is more preferred in these metal. [of nickel and a nickel alloy] If an anisotropic conducting sheet is pressed against a sample, good electric interengagement with an electrode pad will be obtained by piercing a conductive projection in the oxide film of the electrode pad made from aluminum, or shaving an oxide film. Therefore, it is because the characteristic that electric interengagement is good is required of a projection greatly [rigidity]. The precious metals refer to gold, silver, platinum, palladium, iridium, rhodium, osmium, and a ruthenium.

[0036]When a projection consists of nickel or a nickel alloy, it is preferred to cover a projection with the alloy or copper of the precious metals and the precious metals. By covering a projection with the alloy of the precious metals or the precious metals, it is for the electric interengagement nature of a projection to increase further. Therefore, it is the point that electrical resistance is small as the precious metals, and palladium, rhodium, and gold are more preferred.

[0037]As for the thickness of the enveloping layer provided on the surface of a projection, 0.005-0.5 micrometer is preferred, and its 0.01-0.1 micrometer is more preferred. Since an enveloping layer will exfoliate easily if thicker [if thinner than 0.005 micrometer, electric interengagement nature cannot fully be improved but] than 0.5 micrometer, it is not desirable.

[0038]As for the cave covered with the metal layer, it is preferred to cover with the auxiliary layer which consists of any one of the alloys of nickel, a nickel alloy, the precious metals, or the precious metals further. Since rigidity is required for a projection as above-mentioned and a projection is installed by the opening of a cave side by side, rigidity is needed also for a cave. Therefore, when a metal layer consists of gold, silver, copper, etc., in order to improve the rigidity of a cave, it is preferred to provide further the auxiliary layer which consists of rigid high nickel and nickel alloy on a metal layer. In such a case, as for the thickness of an auxiliary layer, 5-15 micrometers is preferred, and its 5-10 micrometers are more preferred. It is because the path of a cave cannot be made small if thicker [if thinner than 5 micrometers, it will be hard to obtain sufficient rigidity, and] than 15 micrometers. On the other hand, since it is in the tendency which runs short of conductivity although a metal layer has rigidity when a metal layer consists of nickel or a nickel alloy, it is preferred to provide further the auxiliary layer which consists of conductive big money, silver, etc. on a metal layer. In such a case, as for the thickness of an auxiliary layer, 1-10 micrometers is preferred, and its 1-5

micrometers are more preferred. It is because sufficient conductivity will not be obtained if thinner than 1 micrometer, but there is no merit in conductive improvement when thicker than 10 micrometers, and the path of a cave cannot be made small.

くて特許請求の範囲によって示され、特許請求の範囲と均等の意味および範囲内でのすべての変更が含まれることが意図される。

【0053】

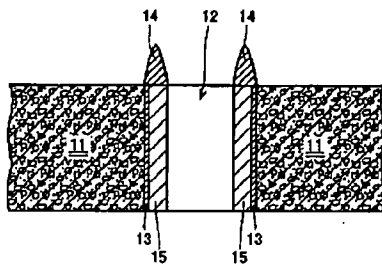
【発明の効果】本発明によれば、検体のアルミ電極パッドに突き合わせるのみで良好な電気接触が得られる異方性導電シートが得られる。また工程数が少なく、高いアスペクト比を有する異方性導電シートの製造方法を提供する。

【図面の簡単な説明】

【図1】 本発明の異方性導電シートを示す断面図である。

【図2】 本発明の異方性導電シートを検体に突き合わせて測定するときの状態を示す図である。すなわち、

【図1】



(a) は突き合わせる前の状態を示し、(b) は突き合わせた後の状態を示し、(c) は(b)における削った状態を示す部分拡大図である。

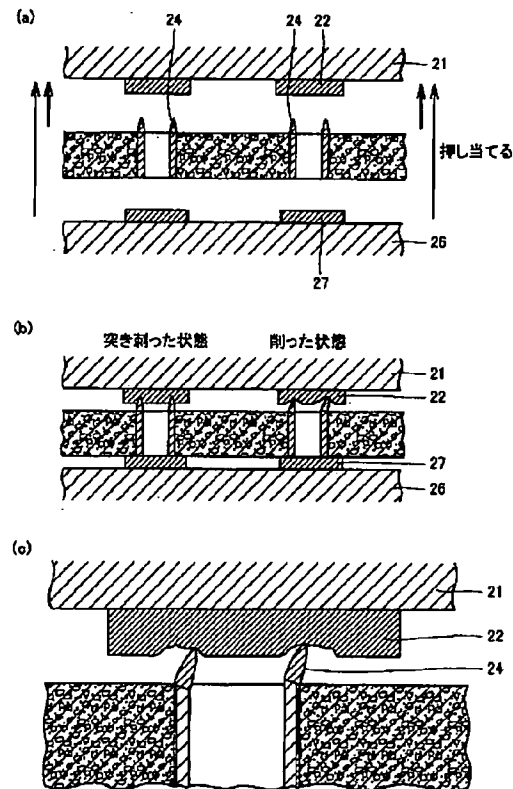
【図3】 本発明の異方性導電シートの斜視図である。

【図4】 本発明の異方性導電シートの製造方法を示す工程図である。

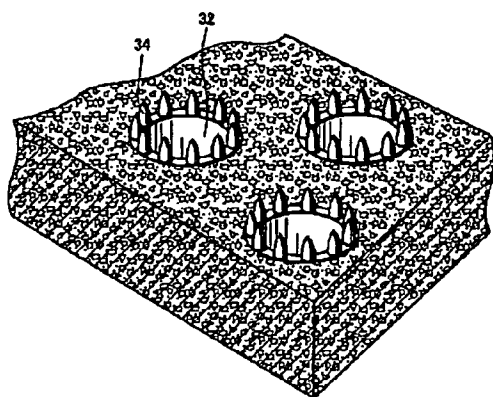
【符号の説明】

- 11 多孔質材料、12, 32 空洞、13, 43 金属層、14, 24, 34, 44 突起、15, 45 補助層、21 ウェハ、22 電極パッド、26 測定ヘッド、27 電極、40 吸収体マスク、41a ePTFE（露光部分）、41b ePTFE（遮光部分）、46 金メッキ層。

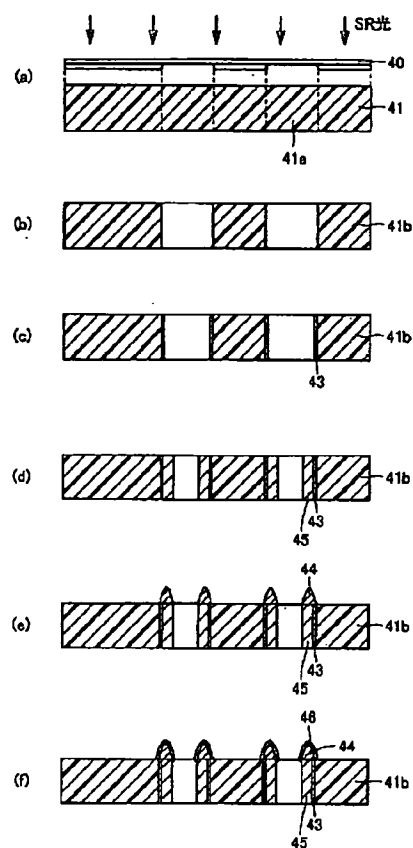
【図2】



【図 3】



【図 4】



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